

Next Generation Active/Passive Sensors for Observing Storm-scale Processes from Space

Completed Technology Project (2015 - 2018)



Project Introduction

The overall objective is to develop the key technologies needed for next generation active/passive microwave instruments for observing storm-scale processes.

The main objective is to develop a highly integrated active/passive microwave system. A combined receiver presents a number of challenges that need to be addressed through a hardware prototype. This activity is developing a prototype combined Ka-band radar/radiometer receiver using existing commercially available components to address some of the fundamental compatibility and calibration issues. An overall system challenge is achieving sufficient receiver protection from the radar transmit power since existing transmit/receive switches that have sufficient bandwidth needed by the radiometer don't have sufficient power handling capability and isolation over the C- to G-band frequency range. There are several approaches to address this problem that will be considered including separation of the transmit/receive chains and advanced pulse compression techniques, such as those employed by RainCube, that lower the overall required transmit power. In addition to these, a parallel effort will focus on developing switch technology that can tolerate higher power, but meet all other requirements for bandwidth, isolation and switching speed.

Anticipated Benefits

A key part of an observatory focused on weather processes will be active/passive microwave sensors to provide a detailed characterization of in-storm dynamics, precipitation processes and thermodynamics. A complete characterization of the storm and its environment will require observations over a broad portion of the microwave spectrum, from as low as 6 GHz to at least 200 GHz. Observations of the mesoscale structure of the storm along with its temporal evolution will be needed. Typical sampling requirements are temporally from minutes to hours and spatially from 1-10 km in the horizontal and 100-1000m in the vertical. Meeting these sampling requirements simultaneously and in a cost effective manner is a challenge and will require a unique system architecture consisting of multiple coordinated observations across several platforms. It is anticipated that several sensor classes will be needed, with small sensors providing context and temporal information which communicate with large-class sensors providing detailed observations of weather targets of interest. The technology developed in this activity will reduce the cost and resources required for these active/passive systems thus enabling new science missions.

Compact active/passive radiometer systems will benefit government and commercial weather monitoring needs by lowering the cost and enhancing the capability from what is currently in use.

This technology will enable observations of complex physical processes in



Project Image
JPL_IRAD_Activities Project

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3
Supported Mission Type	3

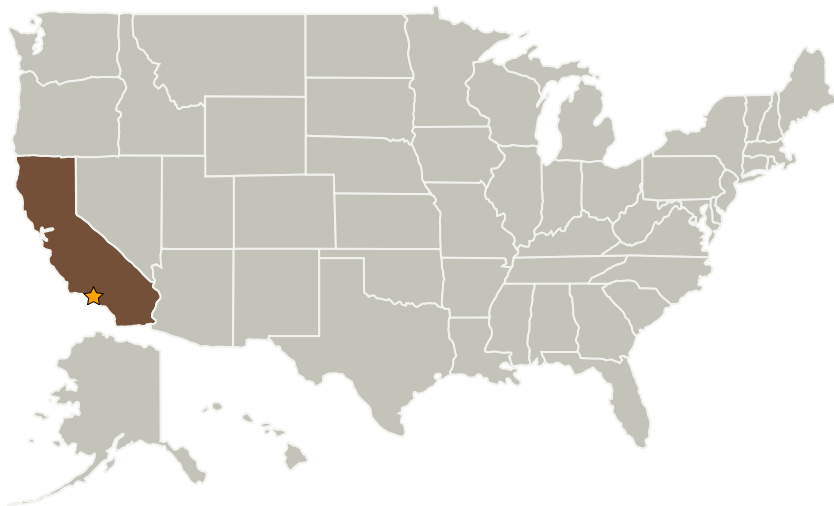
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storms which are used to improve high-resolution numerical weather prediction models. In turn, improved models provide better predictive capability saving lives and money.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

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Images



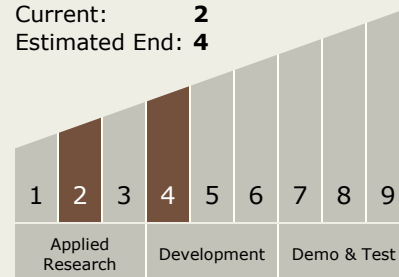
JPL_IRAD_Activities Project Image

Project Image JPL_IRAD_Activities Project

(<https://techport.nasa.gov/image/26087>)

Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 4



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destinations

Earth, Foundational Knowledge

Supported Mission

Type

Push